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Success Story

DYNAMIC TWO-WAY TIME TRANSFER COMMUNICATIONS



Research in time synchronization performed by the Sensors Directorate extends current methodologies, such as the dynamic two-way time transfer (DTWTT), to airborne platforms using multiple communications scenarios. The specific implementation of the system lends itself to integration with standard and tactical communication links. It requires limited bandwidth and provides precise timing information without the need for costly equipment dedicated solely to time recovery.



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Accomplishment

In conjunction with Timing Solutions Corporation, the directorate successfully demonstrated a wireless DTWTT system having the first sub-nanosecond synchronization between an airborne clock and a reference clock on the ground. Implementations of the system included using satellite relays and line-of-sight communication links in the demonstration.

The system is Global Positioning System (GPS)-independent and a significant step forward for airborne timing users, nearly doubling current capabilities. Users can insert this technology into any architecture with communications links.

Background

Static satellite time transfer, operational for nearly 20 years, required a dedicated communications channel. For approximately 6 years, the technology of time-based communications (TBC) embedded timing information in the background of active data communication channels to provide precise static time synchronization to those users with stringent timing requirements.

Users can implement TBC over most communication links, and it is applicable to both existing and planned communication systems. TBC is particularly attractive because it requires less than 4.8 kbps of bandwidth and typically occupies a minimal portion of the overall channel bandwidth.

In addition to its background capability, DTWTT is a totally wireless technology connecting ground-to-air platforms, and it only requires general knowledge of a platform's position and velocity. Researchers use this information in computing corrections to the timing data related to the motion of the platforms and rotation of the earth.

However, accuracies provided by GPS are not necessary, and the system demonstrated sub-nanosecond precision, using only the inertial navigation system of the aircraft. This represents a significant milestone in the fielding of an operational time synchronization system independent of GPS.

Additional information

To receive more information about this or other activities in the Air Force Research Laboratory, contact TECH CONNECT, AFRL/XPTC, (800) 203-6451 and you will be directed to the appropriate laboratory expert. (03-SN-20)

Sensors
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